36TH CONGRESS, 2d Session. } HOUSE OF REPRESENTATIVES. { Ex. Doc. No. 43.

RIFLED CANNON AND THE ARMAMENT OF SHIPS-OF-WAR.

LETTER

FROM

THE SECRETARY OF THE NAVY,

TRANSMITTING

The report of the superintendent of ordnance at the Washington navy yard.

JANUARY 25, 1861.—Referred to the Committee on Naval Affairs, and ordered to be printed.

NAVY DEPARTMENT,
January 22, 1861.

SIR: In compliance with a resolution of the House of Representatives of the 3d instant, I have the honor to transmit herewith "the report of the superintendent of ordnance at the Washington navy yard on rifled cannon and the armament of ships-of-war."

The department on the 8th instant inadvertently communicated to the House, as an answer to this resolution, a report of the superintendent of ordnance at the Washington navy yard on the *armature* of ships-of-war, &c.

I am, very respectfully, your obedient servant,

I. TOUCEY.

Hon. WM. PENNINGTON,
Speaker of the House of Representatives.

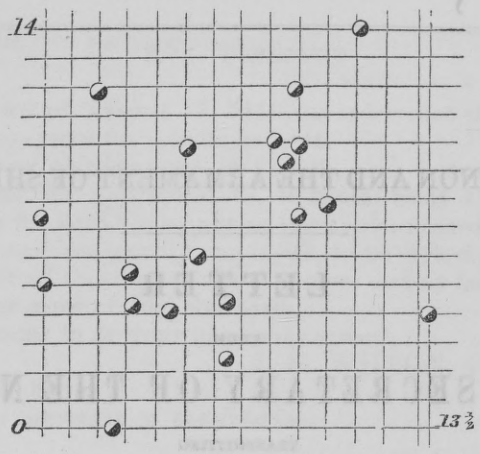
ORDNANCE OFFICE, UNITED STATES NAVY YARD,
Washington, December 12, 1860.

SIR: I submit herewith some of the results of trials made by me with two classes of rifled cannon.

The first is a bronze boat piece, exactly similar in all respects to the present 12-pounder of 750 pounds, except that it is bored to 3.4 inches and rifled; its weight being thereby increased from 750 pounds to 850 pounds. Its shell weighs (empty) 12 pounds.

Nineteen fired at a screen 20 feet high, 40 feet wide, distant 1,300 yards.

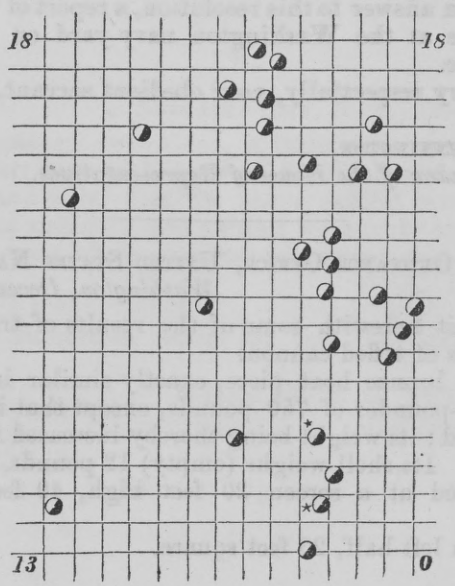
Struck in left half, 20 feet square.



	High.	Wide.	Area sq. ft.	Equal to a square.
All 19 lie in a rectangle	14	13½	189	13¾
The 10 most closely together.	53 per ct.		28½	5⅓
The 12 most closely together.	63 per ct.		32¼	5⅔

Compared to such results of the Armstrong 12-pounder as have been made public on good authority, the relative accuracy is about 13 to 15—a difference too slight, in favor of the English breech-loader, to counterbalance the advantages of simplicity in use and security against accident offered by the facility of loading at the muzzle, with a superiority of range also that insures less curvature of the trajectory at effective distances.

The second class of piece is an iron cannon, with a bore of 5.1 inches, throwing a shot of 50 pounds or a shell of 40 pounds, 30 of which were fired in succession at a screen 20 × 40 feet, distant 1,300 yards. 28 hit and 2 missed. Hits on ricochet are marked with a *.



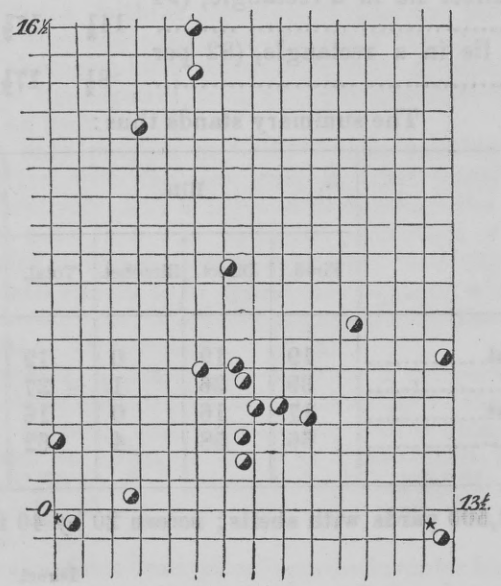
	High, feet.	Wide, feet.	Area.	Square.
26 hit direct in a rectangle, (93 per cent)	18	$12\frac{1}{2}$	225	15
2 hit on ricochet in a rectangle, (93 per cent)	18	$12\frac{1}{2}$	225	15
19 hit direct in a rectangle, (63 per cent)	$11\frac{3}{4}$	$4\frac{3}{4}$	56	$7\frac{1}{2}$
17 hit direct in a rectangle, (57 per cent)	$11\frac{3}{4}$	$3\frac{1}{2}$	$41\frac{1}{8}$	$6\frac{2}{5}$

The area covered by the whole of the perforations was increased by my being compelled to lower the elevation 2′ to 4′ for one-third of the shells, in consequence of a change in the force and direction of the wind; for the shells were striking in the upper half of the screen, and were thereby exposed to the chance of passing over it, as one actually did; otherwise three of the lower shells would have struck higher, and thus have been brought nearer to the central group.

On a subsequent day 19 shells were fired from a gun of the same class.

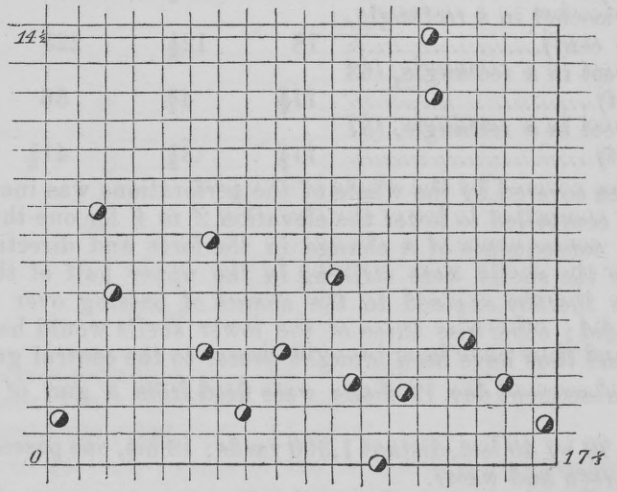
Screen 20 by 40 feet, distant 1,300 yards; 18 hit, one passed between foot of screen and water.

Hits on Ricochet are marked with a *.



	High.	Wide.	Area.	Square.
The 16 direct hits lie in a rectangle, (84 per cent.)	$16\frac{1}{2}$	$13\frac{1}{2}$	213	14
8 direct hits lie in a rectangle, (42 per cent.)	3	$3\frac{8}{10}$	$11\frac{1}{2}$	$3\frac{2}{5}$

Another series fired gave as follows: 17 fired—16 hit direct, 1 w en over; screen 20 by 40 feet, distant 1,300 yards.



	High.	Wide.	Area	Square.
The 16 hits direct lie in a rectangle, (94 per cent.)	14½	17⅓	251	16
14 hits direct lie in a rectangle, (82 per cent.)	8½	17⅓	147½	12

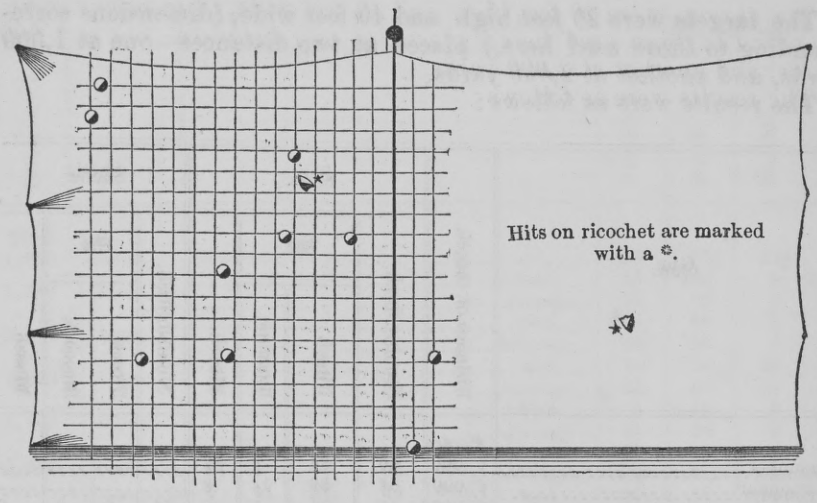
The summary stands thus:

	Hits.				Per cent.	
	Fired.	Direct.	Ricochet.	Total.	Direct.	Total.
12-pounder best	19	19	0	19	100	100
Average	39	36	1	37	92	95
50 pounder best	17	16	0	16	94	94
Average	66	58	4	62	88	94

Practice at 2,500 yards with shells; screen 20 by 40 feet.

	Direct.	Ricochet.	Missed.
11 shells from one pattern	9	1	1*
3 shells from a new pattern	1	1	1
	10	2	2

*Passed so close to head of screen that it cut off the head of the middle pole, which extended 20 inches above the screen.



	High.	Wide.	Area.	Square.
8 direct hits of the 11 were in a rectangle...	13	12½	162½	12¾

The enclosed photo-positive was taken from the navy yard whilst the firing was in progress, just after the 12th fire.

It is, of course, a faithful representation of the screen, and of the perforations as they appeared, and curiously exhibits the power and fidelity of the photographic process at so great a distance. The length of the screen on the negative, from which this positive is taken, is only two-tenths of an inch.

This is the only practice at 2,000* yards possible to this date, whilst that given with the iron gun, at 1,300 yards, is taken as it occurred consecutively, and is believed to represent the average fairly.

It is well to note that this 94 to 100 percentage of hits at 1,300 yards is included in squares whose sides vary from 13¾ to 16 feet.

As some details remain to be definitively adjusted which concern the accuracy of these pieces, it is but reasonable to believe that it is susceptible of further improvement.

As it is, however, I propose to institute a comparison between it and what has been obtained by other authorities in the United States, and for that purpose will refer to the results obtained by a board of officers, under an order of the War Department, to examine and report the capabilities of a projectile invented by Mr. James, which are the most full and authentic that have been yet executed in the United States.

Shot and shells of this description from the inventor himself were fired last summer from pieces of 6-pounder, 12-pounder, and 42-pounder calibre, all of them rifled under his direction and according to his own views. There were also different pieces of like calibre, cut with grooves differing in the extent of the pitch.

* The screen was supposed to have been placed at 2,000 yards, the plane table having been used; when measured with precision by the theodolite, the distance proved to be 1,981½ yards.

The targets were 20 feet high and 40 feet wide, (dimensions corresponding to those used here,) placed at two distances—one at 1,000 yards, and another at 2,000 yards.

The results were as follows:

Gun.	Distance of target.	Shot.				Shells.			
		Number fired.	Hit.		Missed.	Number fired.	Hit.		Missed.
			Direct.	Ricochet.			Direct.	Ricochet.	
	Yards.								
6-pounder	1,000	50	34	4	12	----	----	----	----
12-pounder	1,000	56	39	14	3	----	----	----	----
42-pounder	1,000	45	31	8	6	15	9	0	6
Do	2,000	65	15	7	43	14	0	0	14
		216	119	33	64	29	9	0	20

The percentage of hits deduced by the board includes those made on ricochet as well as direct, though the number of hits is given separately, and the separate *percentage* also in the table at the end; while here in estimating the relative precision of all guns, I have been accustomed *only* to include those made in direct flight, because the dispersion of the several trajectories, which is the measure of accuracy, can only be known by the number of them intercepted on equal surfaces at equal distances, having reference also to the closeness with which they are assembled on that surface. A projectile reflected from another plane, and then striking the screen or target, would have passed below the screen had it continued its original course, and is no more to be included with those striking in direct flight than the shot which miss by passing above. Were it otherwise, an undue advantage would be obtained by pointing rather below the true elevation, so as to make hits by ricochet, and avoid loss by any shot passing over.

I shall therefore always note the percentage of hits direct, as well as in connexion with those in ricochet:

Distance.			Number fired.	Hits, per cent.		
				Direct.	Ricochet.	Total.
Yards						
1,000	James	Shot from 12-pounder	30	73⅓	23⅓	96⅔
1,300	Navy	12-pound shells, best	19	100	0	100
		do, average	39	92	3	95
1,000	James	12-pound shot, best	25	80	0	80
		do, average	50	68	8	76
1,000	James	76¾-pound shot, best	10	70	20	90
		do, average	45	69	18	87
1,000	James	64-pound shells, best	5	80	0	80
		do, average	15	60	0	60
1,300	Navy	40-pound shells, best	17	94	0	94
		do, average	66	88	6	94
2,000	James	76¾-pound shot, best	10	50	10	60
	James	78¾-pound shot, average	65	23	11	34
	Navy	40-pound shells, best	11	82	9	91
	Navy	40-pound shells, average	14	71	14	85

The performance of the James shells was very indifferent; but few were fired, and those only from the 42-pounder—15 at 1,000 yards, and 14 at 2,000 yards—while 216 shot were fired from the various guns.

So far as can be known from this report, the James shells are so deficient in accuracy as to be of little account, and the *shot* only are entitled to consideration, while the practice now reported with the navy cannon is confined to shells, on the presumption that the firing with shot would indicate the usual superiority in steadiness of flight.

The results given by the board from their practice with the James shot, show that its best practice at 1,000 yards gave but 96⅔ per cent. of hits, (of which three-fourths only were direct,) while the best of the navy practice gave 100 per cent. of direct hits at 1,300 yards, (one-third further.)

The James 76¾-pounder *shot*, best firing, gave 70 per cent. of direct hits at 1,000 yards, whilst the navy 40-pounder shell gave 94 per cent. direct hits at 1,300 yards—distance one-third greater.

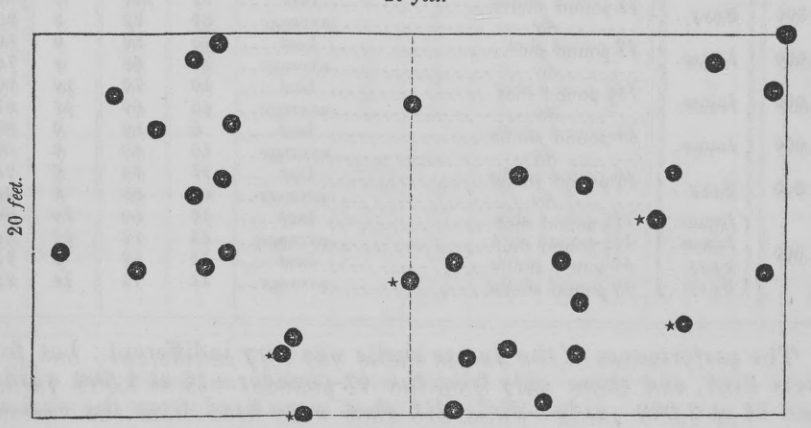
When the screen, at 2,000 yards, was fired at, no one of the James shells struck it—only 60 per cent. of the best practice with his shot, and but 34 in average practice; whilst the best firing with shells from the cannon of this battery, at the same distance, shows 91 per cent. of hits direct, and the average 85 per cent. of direct and ricochet.

The superior claims to accuracy of rifled projectiles over the common spherical I should have conceded—certainly would not have been inclined to question—but that Mr. James, in a communication to the bureau, has asserted it for his projectiles over those of the 9-inch and other guns of that model now mounted in our ships.

I will, therefore, in justice to this class of artillery, refer to some results already before the bureau, which will show that the precision even of shells from these guns is not to be discredited too readily.

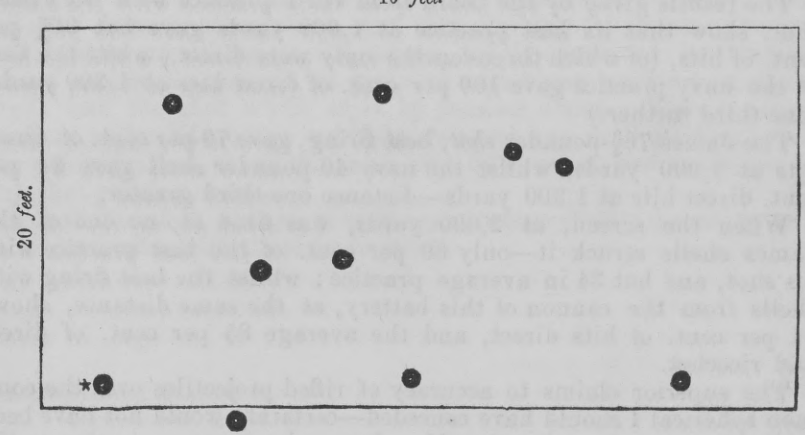
In 1853 ten 9-inch shells were fired at a screen at 1,300 yards, and like all those used here and by the army board, 20 feet by 40 feet wide; seven hit direct, two on ricochet, and one just passed over.*

In 1859 thirty of the same kind were fired, under similar circumstances, of which twenty-one hit direct, and three on ricochet.



Hits on ricochet are marked with a *.

In 1853 ten shells of 11-inch (not reinforced but concentric) were fired at such a screen, 1,300 yards distant; nine hit direct, and one on ricochet.



* See page 97, "Shells and Shell Guns."

From these data we have—

Distance.		No. fired.	Hits, per cent.		
			Direct.	Ricochet.	Total.
Yards.					
1,300	Navy 9-inch, round *shell*.....best...	10	70	20	90
	.....do.....average..	40	70	10	80
1,300	Navy 11-inch round *shell*.....	10	90	10	100
1,000	James's 25-pound *shot*, rifle.....best...	30	73⅓	23⅓	96⅔
	James's 76¾ pound *shot*, rifle ...best...	10	70	20	90
	.....do.....average..	45	69	18	87

So far, therefore, as facts yet known warrant a conclusion, it appears that the performance of spherical 9-inch and 11-inch shells was superior in accuracy to that of the James 76¾-pound shot from rifled cannon, because they struck a given surface *oftener*, at a distance one-third *greater*.

Of course I do not pretend that these round shells will maintain the advantage at ranges practicable to rifled shot; nor that they may not be superseded sooner or later by them. But I may say that the evidence now before the government is very far from establishing the superior accuracy which Mr. James attributes to his rifle shot and shells, even over the round 9-inch and 11-inch shells, and to a distance which will, perhaps, not often be exceeded in *decisive* naval engagements.

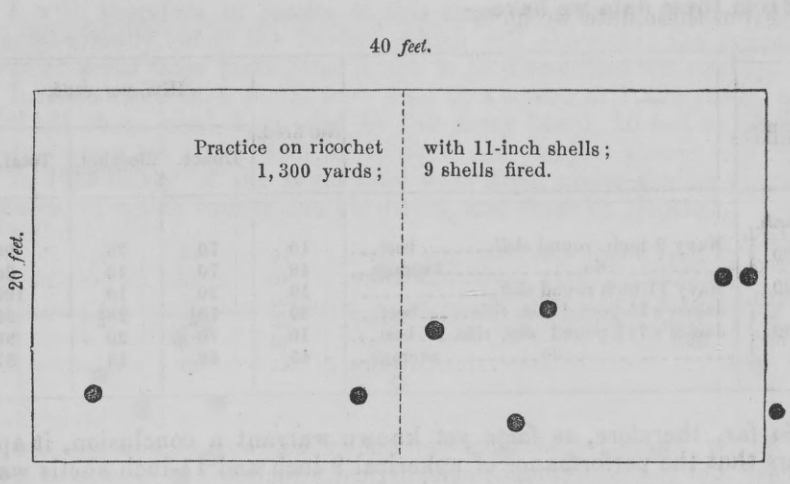
The penetration must be less than that of a shot or a shell from a rifled cannon, but the shock is far superior, the splintering greater, as well as the efficiency of ricochet.

The directness of ricochet, attributed by the board to the James shot, is in its favor, but is almost nullified by the loss of force, which appears from the difference in penetration under each condition, and is explained by the fact that the shot loses its proper direction after striking the plane, and moves obliquely.

Its penetration at 2,000 yards was 39 to 45 inches, while the 40-pounder navy shell pierced 8½ feet of tough soil after ranging 6,700 yards, or nearly four miles. Neither result can be viewed as extraordinary, because under like conditions it would be properly due to any elongated projectile.

In order to exhibit the certainty of large round projectiles on ricochet, by which they are rendered so useful on water, I give the results of such practice at a screen, (20 feet by 40 feet,) made with 11-inch shells, of 135 pounds.

The gun was laid level, and the first contact with the water took place at 250 or 300 yards, the lateral aim only being regarded.



This has the advantage of the direct firing, inasmuch as no one of the shells struck more than ten feet above the water. No rifle cannon can approach this performance on ricochet, either in force or in accuracy, and a seaman can fully appreciate how fatal such a fire would be to a ship.

The present weight of the 5-inch rifled cannon is about 54 hundred weight; of its shot, 50 pounds; and shell, 40 pounds. It will therefore properly class with the 8-inch of either class.

The weight of the 6-inch gun, now being finished, will be about that of the 9-inch gun of the navy, with which it may also be classed. Its shot will weigh about 80 pounds, and its shell 65 pounds.

These weights of gun will no doubt admit of reduction when experience has indicated to what extent it may be carried. But in view of the distrust entertained in England of the endurance of cast-iron for rifled cannon, whilst in France the results are stated to be far from satisfactory, it would scarcely be advisable to diminish the thicknesses which I have used preliminarily.

The mode of bouching seems capable of securing the vent.

The projectiles adopted are of the simplest kind; do not throw off any fragments between the gun and object struck, which is a serious objection to several species of similar projectiles, and have, as already shown, considerable accuracy.

Feeling confident that even this satisfactory condition of muzzle-loading rifled cannon is susceptible of further improvement, I feel warranted in affirming that these pieces may be introduced into service whenever the bureau may feel it desirable to do so.

It remains for me to perfect the details of these guns, and to make a piece of 7-inch bore for shot of 120 pounds and shells of 100 pounds.

A further supply of iron will be required to do this, and to cast a new piece for the pendulum, as well as to replace that which was taken for another purpose, (the gun for Mr. James,) for which I enclose a requisition.

I would also bring to the attention of the bureau the necessity of

at least two more furnaces, in order to avoid losses in casting guns of the present size. It is impossible in such operations to know precisely the amount of iron which will be run, and at this time I have not been able to have any head at all upon either of the iron guns cast, but merely to remove the scoria from them.

Much delay also arises from cleaning the furnaces when used for iron and for brass castings.

The two furnaces would cost about $2,000 each, which is a small amount in comparison to the importance of the object.

It is certainly highly desirable to arrive as quickly as possible at such results as will enable the Navy Department to use its pleasure in rifled cannon, if circumstances should render it expedient to do so, and which I hope to accomplish soon after receiving authority for the measures suggested above.

I beg leave to close by saying that the conclusions here arrived at are not to be understood to favor so radical a change as the entire replacement of the present smooth-bored guns by rifled cannon of *any* kind. This is a question that will need careful experience before proceeding so far; particularly in regard to the probable distances proper for *decisive* firing. So far as accuracy is concerned, the 9-inch and 11-inch shells will compare well with rifled shells, at least to the distance of 1,300 yards. If sea officers feel that this distance is likely to be exceeded, I could not venture to say how much further the accuracy of round shells is to be relied on. But in practicing at 2,000 yards with rifled cannon, I have been forcibly impressed with the exceedingly nice adjustment of every condition required in order to strike a target whose distance was known to a foot. And I am sure that in sea-service no profitable end could be obtained by firing at the largest ship if distant 2,000 yards; occasional shot or shells might strike, but there could be no certainty thereof, and the practice could not be decisive.

The penetrating power is a different matter. The rifled projectile has it far beyond any round projectile ever used at sea; but for the same reason it passes through an object with far less shock, and in that respect is therefore inferior to the round projectile, as it most certainly is in ricochet.

The suggestions which I now beg leave to submit to the bureau may be summed thus:

1st. Mount on every *gun-deck* armed with 9-inch guns, four rifled cannon of 6-inch, throwing shot of 80 pounds, referred to in this report, and on every spar-deck two of like class.

2d. The rifled cannon of 5-inch (50-pounder) may be mounted in batteries carrying guns of less than 9-inch calibre.

3d. Every vessel entitled to more than one boat howitzer, to have one rifled 12-pounder of 800 pounds.

4th. Two more furnaces to be put up in the ordnance foundery, so as to allow of the casting of the heaviest rifled cannon.

5th. An additional supply of iron to enable the execution of these suggestions.

I have the honor to be, very respectfully, your obedient servant,

JNO. A. DAHLGREN,

Commander, in charge of Ordnance Department, in Yard.

Captain GEO. A. MAGRUDER,

Chief of Bureau of Ordnance and Hydrography.

Forwarded by—

FRANKLIN BUCHANAN, *Commanding.*